# 1. Chilled Water System

**CHILLED WATER PRIMARY PUMPS (CHWP-B01-01/02/03/04)**
**PRIMARY LOW RISE HEAT EXCHANGER (PHEX-LR-B01-01/02)**
**CHILLED WATER SECONDARY PUMPS-LOW RISE (CHWS-LR-B01-01/02/03)**
**CHEMICAL DOSING UNIT – SECONDARY LOW RISE**
**PRIMARY HIGH RISE HEAT EXCHANGER (PHEX-HR-B01-01/02/03)**
**CHILLED WATER SECONDARY PUMPS - HIGH RISE (CHWS-HR-B01-01/02/03/04)**
**CHEMICAL DOSING UNIT – SECONDARY HIGH RISE**

## A) System Description

The system consists of 1 set (2 nos.) of heat exchangers for low rise circuit, 1 set (3 nos.) of heat exchangers for high rise circuit, 1 set (3 Duty + 1 Standby) of primary chilled water pumps, 1 set (2 Duty + 1 Standby) of secondary chilled water pumps for low rise circuit and 1 set (3 Duty + 1 Standby) of secondary chilled water pumps for high rise circuit, pressurization unit for low rise circuit on level T14, pressurization unit for high rise circuit on level T51, chemical dozing unit for low rise circuit and chemical dozing unit for high rise circuit.

## B) Primary Pump monitoring

BMS shall monitor individual pumps for the following points.

i. Pump H/O/A Switch ''Auto'' Status (Software Point)
ii. Pump Run Status (Software Point)
iii. Pump Trip Status (Software Point)

## C) Primary High Rise Heat Exchanger monitoring

BMS shall monitor individual heat exchanger hot side inlet & outlet temperatures **(QAE2112.015),** hot side differential pressure (**QBE3000-D2.5)** across inlet & outlet pipes and also secondary side supply header and return header temperatures **(QAE2112.015)**.

Motorized Butterfly valves shall be installed on hot side of heat exchanger. These valves shall be monitored by BMS and commanded to be always open.

## D) Chilled Water Secondary Pumps – High Rise monitoring & control (3 Duty + 1 Standby)

These set of pumps shall supply chilled water from primary high rise heat exchanger located at level B1 to the secondary low rise heat exchanger located at level T14 and secondary high rise heat exchanger located at level T51.

BMS shall control the chilled water pumps only if the H/O/A switch of the pumps is in ‘Auto’ position. 1 no Differential pressure sensor **(QBE3100-D4)** shall be installed at level T51. VFD of pumps shall be

controlled to maintain the differential pressure at set-point (adjustable and to be decided on site during commissioning).

Say, initially the 1st lead pump has been commanded to start. The VFD of the 1st lead pump shall ramp-up as per Proportional-Integral (PI) Logic to maintain the index differential pressure at set point.

In the event of increasing load, the pump shall continue to ramp-up. Once the pump attains a speed of 95%, its speed shall be arrested and the 2nd lead pump shall be commanded to start. The pump shall be ramped up as per PI logic until set point at index has been achieved. If the pump attains a speed of 95%, and still the index pressure set point is not achieved its speed shall be arrested and the 3rd lead pump shall be commanded to start. The pump shall be ramped up as per PI logic until set point at index has been achieved. Once achieved, the speed of 1st and 2nd lead pump shall be decreased and that of the 3rd lead pump shall be increased until all 3 pumps run at the same speeds.

On decreasing load, the speed of the 3 pumps shall be decreased as per PI logic. Once the speed of the pumps fall below 70% (adjustable and to be decided on site during commissioning), the 3rd lead pump shall be decoupled to switch OFF while the 1st and 2nd lead pumps shall continue to run to maintain index pressure at set point. On the load decreasing further, the speed of the remaining 2 pumps shall be decreased as per PI logic. Once the speed of the pumps fall below 65% (adjustable and to be decided on site during commissioning), the 2nd lead pump shall be decoupled to switch OFF while the 1st lead pumps shall continue to run to maintain index pressure at set point.

On further reduction in cooling load, speed of lead pump shall be reduced to not less than 40% (shall be fixed during commissioning as per pump supplier confirmation) due to pump curve characteristics.

BMS shall control secondary pumps as per above logic and shall also perform run hour equalization over the 4 pumps. Change over shall be initiated every 24 hours of run time.

In the event of BMS giving a start/stop command to a pump and the run status of the same is not established by liquid differential pressure switch **(AX-LDPS-3382-4)** after an interrogation time of 30 seconds (adjustable), BMS shall raise a secondary pump failed to run alarm. BMS shall disable all commands to the pump and the next lead pump shall be commanded to switch on. The faulty pump shall not run until alarm for the same has been acknowledged and reset from the BMS workstation. The same shall be followed under trip conditions.

### E) Chemical Dozing Unit – Secondary Low Rise

The following points shall be monitored by BMS.

i. System Healthy Status
ii. Common Fault Alarm

### F) Primary Low Rise Heat Exchanger monitoring

BMS shall monitor individual heat exchanger hot side inlet & outlet temperatures **(QAE2112.015),** hot side differential pressure (**QBE3000-D2.5)** across inlet & outlet pipes and also secondary side supply header and return header temperatures **(QAE2112.015)**.

Motorized Butterfly valves shall be installed on hot side of heat exchanger. These valves shall be monitored by BMS and commanded to be always open.

**G) Chilled Water Secondary Pumps – Low Rise monitoring & control (2 Duty + 1 Standby)**

These set of pumps shall supply chilled water from primary low rise heat exchanger located at level B1 to the connected load from level B3 to level T14.

BMS shall control the chilled water pumps only if the H/O/A switch of the pumps is in 'Auto' position.

2 nos Differential pressure sensors **(QBE3100-D4)** shall be installed at level T02 and T14. VFD of pumps shall be controlled to maintain the differential pressure set-points assigned for T02 and T14, whichever is having the maximum load (adjustable and to be decided on site during commissioning).

Say, initially the 1st lead pump has been commanded to start. The VFD of the 1st lead pump shall ramp-up as per Proportional-Integral (PI) Logic to maintain the index differential pressure set point (maximum load).

In the event of increasing load, the pump shall continue to ramp-up. Once the pump attains a speed of 95%, its speed shall be arrested and the 2nd lead pump shall be commanded to start. The pump shall be ramped up as per PI logic until set point at index has been achieved. Once achieved, the speed of 1st lead pump shall be decreased and that of the 2nd lead pump shall be increased until both pumps run at the same speeds.

On decreasing load, the speed of two pumps shall be decreased as per PI logic. Once the speed of the pumps falls below 65% (adjustable and to be decided on site during commissioning), the second lead pump shall be decoupled to switch OFF while the 1st lead pump shall continue to run to maintain index pressure at set point.

On further reduction in cooling load, speed of lead pump shall be reduced to not less than 40% (shall be fixed during commissioning as per pump supplier confirmation) due to pump curve characteristics.

BMS shall control secondary pumps as per above logic and shall also perform run hour equalization over the three pumps. Change over shall be initiated every 24 hours of run time.

In the event of BMS giving a start/stop command to a pump and the run status of the same is not established by liquid differential pressure switch **(AX-LDPS-3382-4)** after an interrogation time of 30 seconds (adjustable), BMS shall raise a secondary pump failed to run alarm. BMS shall disable all commands to the pump and the next lead pump shall be commanded to switch on. The faulty pump shall not run until alarm for the same has been acknowledged and reset from the BMS workstation. The same shall be followed under trip conditions.

## H) Alarms

The followings alarms shall be raised on BMS

| S.NO. | ALARM | PRIORITY |
|---|---|---|
| 1 | Hot side motorized butterfly valve not open Alarm (each valve) | High |
| 2 | Primary high rise HEX supply header high temperature Alarm (Temp > 8 °C for more than 5 minutes) | Medium |
| 3 | Primary low rise supply header high temperature Alarm (Temp > 8 °C for more than 5 minutes) | Medium |
| 4 | Chilled water pump VFD trip alarm (each pump) | High |
| 5 | Chilled water pump Failed to On Alarm (each pump) | High |
| 6 | Pressurization unit pump trip alarm (each pump) | Low |
| 7 | Chemical dozing unit common fault alarm (each unit) | Low |
| 8 | Chilled water pump maintenance alarm (each pump) | Low |

**Note:-** Maintenance alarms shall be raised based on run hours.

## I) Trends

The following points shall be trended at every 10 minutes of interval:

i. HEX hot side inlet temperature
ii. HEX hot side outlet temperature
iii. HEX hot side differential pressure
iv. Hot side common header supply temperature
v. Hot side common header return temperature
vi. Pump VFD Feedback
vii. Chilled water index differential pressure reading
viii. Chilled water index differential pressure set point
ix. Motorized butterfly valve open status